FINDING PRODUCTIVE INTERSECTIONS BETWEEN ENGINEERING AND THE HUMANITIES

Lydia Wilkinson
University of Toronto
lydia.wilkinson@utoronto.ca

Abstract – The importance of a liberal arts education for engineers is articulated in both the CEAB and ABET accreditation criteria, but while these stipulate minimum complementary studies requirements, the degree to which faculties provide opportunities for immersion in the liberal arts varies across institutions. An understanding of the types of approaches that various faculties are taking to facilitate this immersion can provide useful models for successful integration of liberal arts opportunities. This paper will provide a survey of the intersection of arts and engineering across faculties in Canada and the US, in order to gain an understanding of both the methods of liberal arts integration and its perceived value.

Keywords: liberal arts, complementary studies, interdisciplinary, collaboration

1. INTRODUCTION

Arguments for a liberal education for engineers identify a number of positive outcomes stemming from required courses in the Humanities and Social Sciences: through immersion in the liberal arts students become more culturally aware, are capable of inter- and cross-disciplinary collaboration, have stronger communication skills, and are capable of learning outside of their discipline even after leaving the academic environment [1, 3, 4, 5, 6, 9, 12]. These benefits are underscored by CEAB and ABET’s accreditation criteria, which stipulate minimum complementary studies requirements for the completion of an engineering degree.

Yet while the value of liberal arts is acknowledged within the discourse of engineering education and reiterated through the requirements of our accreditation boards, the logistics of integrating these educational opportunities remains complex. Challenges to successful integration include the competing demands of a heavy core curriculum, the availability of elective courses to non-arts and science students, and faculty and student buy-in. Faculties across North America have undertaken various initiatives to overcome these challenges, which range on the one hand from substantial liberal arts requirements and the fostering of interdisciplinary collaboration, to on the other, minimal mandatory electives outside of the engineering discipline. The extent to which institutions foster collaboration between engineering and the liberal arts is reflective of the value they place on this type of education for their engineering students, as well as the ease of integrating interdisciplinary opportunities within their academic structure. This paper will provide a preliminary survey of approaches in the field to gain an understanding of how some schools within North America are promoting liberal arts engagement within the engineering discipline.

For the purposes of this study institutions have been classified into three general types: technical schools that offer a holistic education through liberal arts departments serving engineering majors; private liberal arts colleges offering engineering programs with significant arts and humanities requirements; and larger universities offering a range of degrees from multiple departments, in which alternative interdisciplinary collaborations may take place. At this preliminary stage information has been gathered through online content from these institutions. At a future stage this initial information will be expanded through interaction with members of these institutional communities.

2. RETHINKING A TECHNICAL EDUCATION

A number of private technical colleges within the US have responded in recent years to calls for a holistic engineering education. These schools are characterized by investment in people-centred engineering, hands-on learning and an understanding of the societal implications and opportunities of the discipline. Three colleges that are representative of this approach are Olin College, Harvey Mudd and Rose-Hulman, and all three place a similar importance on a broader curriculum facilitated by access to arts and science course offerings.

With its official opening in 2002, Olin College could define itself as “a new kind of engineering college”
offering a curriculum that, from its outset, acknowledged the value of a broad, socially conscious education. As such, alongside hands-on project experience and opportunities for close collaboration with educators and industry, students are required to engage with disciplines outside the engineering field. Students must complete twenty-eight Arts, Humanities and Social Sciences or Entrepreneurship credits in addition to their engineering curriculum. Of these twenty-eight credits twelve must be completed in a declared concentration, typically characterized by three related courses (or two courses and a capstone) approved by their department. Many of Olin’s in-house Arts, Humanities and Social Science courses underscore the value of intersections between disciplines, reflected in courses like “The Intersection of Art and Science” and “The Stuff of History: Materials and Culture in Ancient, Revolutionary and Contemporary Times.” In addition to courses offered within Olin, students can elect to complete transfer credits at its affiliated colleges, Babson and Wellesley. [13]

Harvey Mudd’s investment in the liberal arts for engineers is evident in the school’s website description, which acknowledges the institution’s STEM focus while underscoring the importance of engagement with subjects outside of these fields. The site reads:

Mudd offers nine engineering, science and mathematics-based majors, all grounded in a solid core curriculum that includes a healthy dose of humanities and social science courses. Why? Because we know that you don’t have to sacrifice your interest in music or art (or anything else) to be good scientists. And because an understanding of history and politics will make us more effective engineers, chemists, lawyers, doctors and human beings. [7]

This understanding of history and politics as well as other liberal arts disciplines is offered through courses ranging from the visual arts to religion, philosophy and literature. The integrative nature of humanities and social science courses at Harvey Mudd is evidenced by the sharing of faculty members between departments; while a core faculty of arts and science professors lead the majority of course offerings, a small number of arts-focused courses are taught by professors housed in technical departments like computer science and physics. Students are required to take ten courses from the Humanities and Arts and Science listings in addition to a common foundations course. [8]

While Rose-Hulman’s mission focuses on technical and engineering excellence, its website also lists opportunities for artistic and cultural immersion within the university and surrounding area. Engineering students are required to complete nine Humanities and Social Science electives for graduation. In addition to this requirement, interested students have the opportunity to minor in their choice of fourteen different liberal arts disciplines, including Anthropology, Art, East Asian Studies, Economics, European Studies, Geography, German, History, Japanese, Language and Literature, Latin American Studies, Music, Political Science, Philosophy and Religion, Psychology and Spanish. [18]

These three schools provide positive models for the integration of liberal arts into an engineering education. While the importance of the liberal arts as articulated in the school’s mandates and reflected in their range of course offerings varies between each institution, their significant liberal arts requirements points to the practical value of connecting students to disciplines and knowledge outside of their technical field.

3. EXPLOITING OPPORTUNITIES IN LIBERAL ARTS COLLEGES

In her article, “Liberal Arts and Education” Catherine Koshland, Vice Provost and Engineering Professor at UC Berkeley relays her own unusual trajectory from an undergraduate degree in art history to a PhD in engineering while discussing the value of a liberal arts education for engineers. Koshland identifies a number of liberal arts schools currently offering engineering degrees that encourage greater immersion in artistic and humanities disciplines in addition to the technical degree requirements. While her list of notable institutions includes Swarthmore and Lehigh, as well as Smith College (where the introduction of an engineering degree in 1999 was an important milestone for increased female representation within the STEM disciplines) Koshland’s description of Union College’s program provides the most novel intersection points for the focus of this study. A 2005 strategic plan at Union led administrators to reconsider the traditional engineering/arts divide and to find ways that both faculties could benefit from cross-disciplinary collaboration; arts and humanities could learn from the type of scientific rigor and methods practiced within the applied sciences, while at the same time the liberal arts could work to provide a social context for engineering disciplines. Koshland explains:

It became clear that an educated person in the 21st century needed to understand science and technology and the intellectual process of discovery and design that is fundamental to engineering practice. One could equally make the case, that for engineering solutions to be successful in the 21st century, they must respond to social, cultural, and economic conditions of the communities that embrace the solution. [11]

What emerged was a strategic plan that sought opportunities for cross-faculty research and collaboration, including cross-appointed courses in the humanities and engineering, like one in which students study The Odyssey from a literary perspective while simultaneously investigating technical challenges that Odysseus encountered during his quest [11].

Union College’s approach is particularly unique for the lack of hierarchy suggested by its model—neither
faculty is seen as serving the other, instead, the pursuit of liberal arts and engineering disciplines are seen as integrally linked and mutually beneficial.

Rensselaer Polytechnic has extended its interdisciplinary approach to the degree granting level, with a number of programs existing at the intersection of multiple disciplines. Notably, their Design, Innovation and Society program requires students to complete design courses from the Humanities and Social Sciences alongside their technical specialization, which might include engineering. Similarly, the Mind and Machines program allows students to partner a psychology degree with a degree in mechanical, computer or systems engineering. [14] While the largely technical focus of these program offerings is not surprising, given that Rensselaer is a polytechnic institute, they once again speak to the value of interdisciplinary collaboration in illustrating the practical relevance of traditional engineering fields.

The comparatively small size and centralized administrative structure of these schools is arguably quite important to their success in conceiving of and integrating a shared interdisciplinary vision across faculties. Nevertheless, the importance placed on dialogue across disciplinary boundaries in these schools can provide important examples for much larger and administratively complex institutions.

4. FINDING ALTERNATE PATHWAYS WITHIN A TRADITIONAL SETTING

Cross-disciplinary initiatives are admittedly more difficult in larger institutions, where humanities and social science departments and engineering departments may be working on the same campus with very little direct communication or shared planning. Nevertheless, a few large institutions within Canada and the United States are finding novel ways to integrate the arts into engineering and the sciences without overhauling curriculum at the institutional level. These initiatives are often extracurricular in nature, and provide students with an opportunity to work in a new artistic environment without necessarily earning credit.

The University of Virginia’s Engineering in Context projects group students into multidisciplinary project design teams for their capstone credit. Teams may consist of engineering students working together with colleagues from commerce, architecture, nursing and education or arts and science [17]. Given that the projects are devised and planned by the student participants, they are reflective of the diverse interests of these student teams. One carefully documented project, “Inside the Box” is noteworthy for its departure from conventional engineering streams. This particular project brought together students in a first year engineering class, a playwrighting class and a directing class to create scene performances utilizing their respective area of expertise. The student engineers, working within the parameters of a prescribed stage space and apparatus, provided the visual and sound effects for the student written and directed works [17].

Similar intersections of engineering and the visual and performed arts is evident at the University of Waterloo, where the Canadian Centre of Arts and Technology supports research initiatives that bring together artists and technology specialists from within the university and the larger community [16]. While the centre’s full time staff is made up of faculty from the university’s Digital Arts Communication Program and Department of Speech and Drama [17], their collaborations strike partnerships with a range of local tech companies and academics from outside of the centre. A 2009 project for example, saw members of the centre work alongside a colleague from the Business Entrepreneurship and Technology Centre within the University of Waterloo’s Faculty of Engineering to introduce a new digital display technology to Toronto’s theatre community. Projects like this encourage students from both the liberal arts and STEM disciplines to consider the opportunities for entrepreneurial development between the two fields.

The Collaborative Catalyst @ MIT, while not strictly for engineers, brings the arts community on to campus and into a largely technical university. The partnership between MIT and two community theatre companies produces plays on scientific topics performed at the Central Square Theatre. These performances are complimented by a speaker series to discuss the scientific content of the works. The theatre’s proximity to and affiliation with MIT facilitates the exchange of ideas between the artistic and scientific communities to enrich the theatrical experience. [2]

The study of science through theatre is similarly facilitated by one of the University of Toronto’s five electives for engineers, Representing Science on Stage. These electives, offered by faculty from the Engineering Communication Program, provide students with the opportunity to complete their humanities and social sciences requirements within a classroom populated exclusively by their engineering peers. The curriculum for these courses encourages students to approach a traditional arts topic—the visual and plastic arts, linguistics, rhetoric, or science writing—while drawing on their unique subject-knowledge.

The University of Michigan’s Renaissance Project tears down disciplinary silos within and outside the arts and science and engineering classrooms by working to reimagine campus geography. Students from different disciplines are no longer ghettoized to a particular area of campus, but must interact with colleagues from multiple disciplines in shared building spaces. [4]
While these various initiatives represent formal projects undertaken by university administrators and faculty, numerous other student-led organizations speak to student engagement in liberal arts subjects. Within the University of Toronto for example, a range of clubs cater to performing and fine arts interests; the student society or Skule’s club page lists five musical societies, a fine arts club, a talent show and improv club, in addition to its annual musical revue, Skule Night. While the University of Toronto is admittedly a limited sample, the significant number of organizations within this highly academic and rigorous program may reflect similar strengths in other institutions.

While the activities undertaken by these centres and clubs are not always associated with academic credit, they nevertheless provide important opportunities to extend academic knowledge through collaboration with individuals and subjects outside the typical engineering field. In this way they present another important paradigm for liberal arts immersion for engineers.

5. CONCLUSION

While this paper began by characterizing liberal art integration around three institutional models: liberal arts colleges, institutions with an engineering focus, and larger universities offering multiple degrees across large diverse faculties, we can also understand these projects based on their institutional scope; while some projects are reflective of a college or university’s central mandate, others are made possible through the individual interests of a department, centre or affiliate organization. These multiple entrance points for collaboration are closely linked to differences in institutional and administrative structures, which may present particular challenges to successful liberal arts integration.

A next step in this ongoing study will be to contact representatives from the programs discussed here in order to develop greater familiarity with their programs and a more thorough understanding of how groups, individuals and institutions can work to find fruitful intersections between the liberal arts and engineering.

References